IN THE CLAIMS

Complete listing of the claims:

CLAIMS

1. (Previously presented) An optical coupling system for coupling optical energy between optical devices, the system comprising:

a waveguide receptive of N-mode radiation from a radiation source where N is an integer;

the waveguide comprising:

a first section receptive of the N-mode radiation from the optical beam redirection device and having a thickness of *h* and being asymmetric in shape;

a second section having a thickness of *t* wherein *t* is less than *h*; and

a tapered section having a first end thereof with a thickness of *h* joined with the first waveguide section and a second end thereof with a thickness of *t* joined with the second waveguide section for coupling the N-mode radiation from the first waveguide section to the second waveguide section.

2. (Original) The optical coupling system as set forth in Claim 1 further comprising an optical beam redirection device receptive of the N-mode radiation from the radiation source for directing the N-mode radiation to the first waveguide section.

3. (Original) The optical coupling system as set forth in Claim 1 wherein *h* is approximately 10-100 um and *t* is approximately 2-10 um.

4. (Original) The optical coupling system as set forth in Claim 1 wherein the tapered section has a length of approximately 100-1000 um.

5. (Previously presented) An optical coupling system for coupling optical energy between optical devices, the system comprising:

a waveguide receptive of N-mode radiation from a radiation source where N is an integer;

the waveguide comprising:

a first section receptive of the N-mode radiation from the optical beam redirection device and having a thickness of *h*;

a second section having a thickness of *t* wherein *t* is less than *h*; and

a tapered section having a first end thereof with a thickness of *h* joined with the first waveguide section and a second end thereof with a thickness of *t* joined with the second waveguide section for coupling the N-mode radiation from the first waveguide section to the second waveguide section

wherein the first end of the tapered section includes a first aperture and the second end of the tapered section includes a second aperture substantially parallel to the first aperture and wherein the first and second apertures are spaced apart from one another so that the tapered section subtends a first angle, α, of about 5-10 degrees and a second angle, β, perpendicular to the first angle, α, of about 5-10 degrees at the second waveguide section.

6. (Original) The optical coupling system as set forth in Claim 2 wherein the optical beam redirection device comprises a prism.

7. (Original) The optical coupling system as set forth in Claim 2 wherein the optical beam redirection device comprises a lens or a diffraction grating.

8. (Original) The optical coupling system as set forth in Claim 1 further comprising a cladding having a refractive index of n_w and encasing the waveguide having a refractive index of n_c; wherein n_w is less than n_c.

9. (Original) The optical coupling system as set forth in Claim 1 wherein the first waveguide section and the tapered section are defined by a refractive index, n_w, and the second waveguide section is defined by a refractive index, n_c, and wherein n_c is greater than n_w.

10. (Original) The optical coupling system as set forth in Claim 9 wherein the second waveguide section is a cladding encasing the optical beam redirection device, the first waveguide section and the first tapered section.

11. (Original) The optical coupling system as set forth in Claim 9 wherein the second waveguide section further comprises a top-layer tapered section wherein the refractive index difference between the second waveguide section and the tapered section is extended from an upper surface of the second waveguide section to a point along the tapered section.

12. (Original) The optical coupling system as set forth in Claim 9 wherein the second waveguide section includes a segment thereof positioned within the first tapered section.

13. (Previously presented) An optical coupling system for coupling optical energy between optical devices, the system comprising:

a waveguide receptive of N-mode radiation from a radiation source where N is an integer;

the waveguide comprising:

a first section receptive of the N-mode radiation from the optical beam redirection device and having a thickness of h;

a second section having a thickness of t wherein t is less than h; and

a tapered section having a first end thereof with a thickness of h joined with the first waveguide section and a second end thereof with a thickness of t joined with the second waveguide section for coupling the N-mode radiation from the first waveguide section to the second waveguide section;

wherein the first waveguide section and the tapered section are defined by a refractive index, n_w, and the second waveguide section is defined by a refractive index, n_c, and wherein n_c is greater than n_w;

wherein the second waveguide section includes a segment thereof positioned within the first tapered section; and

wherein the segment of the second waveguide section positioned within the first tapered section is a wedge having a triangular in cross section including a base with a length *t* joined with the second waveguide section and an angled apex opposed to the base;

wherein the wedge is receptive of the N-mode radiation from the first tapered section for coupling the N-mode radiation from the first waveguide section to the second waveguide section.

14. (Original) The optical coupling system as set forth in Claim 13 wherein the triangular cross section is inclined with respect to the second waveguide section.

15. (Original) The optical coupling system as set forth in Claim 9 wherein the second waveguide section includes a segment thereof positioned within the first tapered section and the first waveguide section.

16. (Original) The optical coupling system as set forth in Claim 13 wherein the angled apex of the wedge includes an angle of about 5-10 degrees.

17. (Original) The optical coupling system as set forth in Claim 13 wherein the wedge includes a length of about 100-1000 um.

18. (Currently amended) An optical coupling system for coupling optical energy between optical devices, the system comprising:

a first waveguide having a thickness of *c* and a refractive index of n_w, and receptive of the N-mode radiation from a radiation source along an axis;

a second waveguide having a segment thereof positioned within the first waveguide and having a thickness of *t*, wherein *t* is less than *c* and a refractive index of n_c wherein n_c is greater than n_w wherein the segment of the second waveguide positioned within the first waveguide includes a wedge having a triangular cross section including a base with a length *t* joined with the second waveguide section and an angled apex opposed to the base;

wherein the wedge is receptive of the N-mode radiation from the optical beam

redirection device for coupling the N-mode radiation from the optical beam redirection device to the second waveguide section.

19. (Original) The optical coupling system as set forth in Claim 18 further comprising an optical beam redirection device receptive of the N-mode radiation from the radiation source for directing the N-mode radiation to the first waveguide where N is an integer.

20. (Canceled)

21. (Currently amended) The optical coupling system as set forth in Claim [[20]] 18 wherein the wedge is inclined with respect to the second waveguide section.

22. (Currently amended) The optical coupling system as set forth in Claim [[20]] 18 wherein the angled apex of the wedge includes an angle of about 5-10 degrees.

23. (Currently amended) The optical coupling system as set forth in Claim [[20]] 18 wherein the wedge includes a length of about 100-1000 um.

24. (Original) The optical coupling system as set forth in Claim 19 wherein a segment of the first waveguide is truncated by a distance *d*.

25. (Original) The optical coupling system as set forth in Claim 19 wherein the second waveguide is offset from the axis of the N-mode radiation by a distance *r*.

26. (Original) An optical coupling system for coupling optical energy between optical devices, the system comprising:

an optical beam redirection device receptive of N-mode radiation from a radiation source where N is an integer;

a waveguide having a refractive index of n_w and receptive of the N-mode radiation from the optical beam redirection device along an axis;

the waveguide comprising:

a first section receptive of the N-mode radiation from the optical beam redirection device;

a tapered section receptive of the N-mode radiation from the first waveguide section; and

a third section positioned within the tapered section, the third section having a refractive index of n_s and receptive of the N-mode radiation from the tapered section;

wherein n_s is greater than n_w.

27. (Original) The optical coupling system as set forth in Claim 26 wherein the third waveguide section is offset from the axis of the N-mode radiation by a distance *r*.

28. (Canceled) A waveguide device comprising:

a first aperture having a first cross sectional area and receptive of optical radiation;

a second aperture having a second cross sectional area less than the first cross sectional area and receptive of the optical radiation from the first aperture.

29. (Canceled) The waveguide device as set forth in Claim 28 wherein the waveguide device defines first and second angles between the first and second apertures wherein the first angle, α, is about 5-10 degrees and the second angle, β, perpendicular to the first angle, α, is about 5-10 degrees.

30. (Canceled) The waveguide device as set forth in Claim 28 wherein the waveguide device has a length of approximately 100-1000 um.

31. (Previously presented) An optical coupling system for coupling optical energy between optical devices, the system comprising:

an optical beam redirection device receptive of N-mode radiation from a radiation source where N is an integer;

a waveguide receptive of the N-mode radiation from the optical beam

redirection device;

the waveguide comprising:

a first section receptive of the N-mode radiation from the optical beam redirection device and having a thickness of *h* and being asymmetric in shape;

a tapered section having a first end thereof with a thickness of *h* joined with the first waveguide section and a second end thereof with a thickness of *t* for coupling the N-mode radiation from the first waveguide section to a second waveguide.

32. (Original) The optical coupling system as set forth in Claim 31 wherein the first end of the tapered section includes a first aperture and the second end of the tapered section includes a second aperture substantially parallel to the first aperture and wherein the first and second apertures are spaced apart from one another so that the tapered section subtends a first angle, α, of about 5-10 degrees and a second angle, β, perpendicular to the first angle, α, of about 5-10 degrees at the second waveguide.

33. (Previously presented) An optical coupling system for coupling optical energy between optical devices, the system comprising:

a radiation source;

an optical beam redirection device positioned a prescribed distance from the radiation source and receptive of N-mode radiation therefrom where N is an integer;

a waveguide receptive of the N-mode radiation from the optical beam redirection device;

the waveguide comprising:

a first section receptive of the N-mode radiation from the optical beam redirection device and having a thickness of *h* and being asymmetric in shape;

a second section having a thickness of *t* wherein *t* is less than *h*; and

a tapered section having a first end thereof with a thickness of *h* joined with the first waveguide section and a second end thereof with a thickness of *t* joined

with the second waveguide section for coupling the N-mode radiation from the first waveguide section to the second waveguide section.

34. (Original) The optical coupling system as set forth in Claim 33 wherein the first end of the tapered section includes a first aperture and the second end of the tapered section includes a second aperture substantially parallel to the first aperture and wherein the first and second apertures are spaced apart from one another so that the tapered section subtends a first angle, α, of about 5-10 degrees and a second angle, β, perpendicular to the first angle, α, of about 5-10 degrees at the second waveguide section.